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DEPARTMENT OF THE NAVY **NFGS-SF-15950B**
NAVAL FACILITIES **30 September 1999**
ENGINEERING COMMAND **----------**
GUIDE SPECIFICATION **Superseding NFGS-SF-15950A (01/99)**
SHORT FORM
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DIVISION 15 - MECHANICAL

SECTION 15950

TESTING/ADJUSTING/BALANCING FOR SMALL HVAC SYSTEM

09/99

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TESTING/ADJUSTING/BALANCING FOR SMALL HVAC SYSTEM

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Any changes or revisions to this document since the date of the original approval for NAVFAC, have been performed by the Guide Specifications Division (Code 15G).

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SECTION 15950

TESTING/ADJUSTING/BALANCING FOR SMALL HVAC SYSTEM
09/99

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NOTE: This Short Form Guide Specification is for use in preparing project specifications for small projects, repair or maintenance work. It may also be used for minor elements or small quantities of work in larger projects at the discretion of the Engineer/Architect in charge. If a more detailed specification is required, use the NFGS series of specifications.
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NOTE: This guide specification covers requirements for testing, adjusting, and balancing (TAB) of small heating, ventilating, and cooling (HVAC) air and water distribution systems. Small HVAC systems include:

1. Rooftop package A/C 35 kW 10 tons or less (no more than two units on the project)

2. Direct expansion, split system with air-handling units or fan coil units, constant volume/variable temperature system 17.5 kW 5 tons or less (no more than three units on the project)

3. Hot water heating only, comprised of vertical/horizontal unit heaters, hot water pump and converter, fin tube radiation, convectors, and exhaust fans only (no large makeup air units, industrial exhaust systems).

Multizone units of any tonnage or VAV systems are not considered small systems.
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NOTE: This revision "B" to NFGS-SF-15950 amends the issue dated 29 January 1999 by revising the submittal article to comply with the agreement reached by the SPECSINTACT Tri-Agency Committee.

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NOTE: Following information shall be shown on project drawings:

1. Room numbers.

2. A unique number or mark for each piece of equipment or terminal.

3. Air quantities at air terminals.

4. Air quantities and temperatures in air handling unit schedules.

5. Water quantities and temperatures in thermal energy transfer equipment schedules.

6. Water quantities and heads in pump schedules.

7. Water flow measurement fittings and balancing fittings.

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PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

ASSOCIATED AIR BALANCE COUNCIL (AABC)

AABC NSTSB	(1989) Total System Balance

NATIONAL ENVIRONMENTAL BALANCING BUREAU (NEBB)

NEBB MASV	(1994) Measurement and Assessment of Sound and Vibration
NEBB TABES	(1991) Testing, Adjusting, Balancing of Environmental Systems

SHEET METAL & AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION, INC. (SMACNA)

SMACNA HVACADLTM	(1985) HVAC Air Duct Leakage Test Manual
SMACNA HVACTAB	(1993) HVAC Systems Testing, Adjusting and Balancing

1.2 PERFORMANCE REQUIREMENTS

Before starting work, ensure that construction management team certify in writing to the Contracting Officer that the construction has been completed

and every phase of the HVAC is operating in accordance with the design requirements. Perform testing, adjusting, and balancing (TAB) of [new and existing] small heating, ventilating, and cooling (HVAC) air and water distribution systems including equipment, ducts, and piping which are located within, on, under, between, and adjacent to buildings.

1.3 DEFINITIONS

a. TAB: Testing, Adjusting, and Balancing

b. DALT: Duct air leakage testing.

c. Out-of-tolerance data: Pertains only to field checking of certified DALT or TAB report. The term is defined as a measurement taken during field checking which does not fall within the range of plus 10 to minus 10 percent of the original measurement reported on the certified DALT or TAB report for a specific parameter.

1.4 TAB QUALIFICATIONS

TAB work shall be performed by a firm actively engaged in the business of balancing air conditioning systems. Personnel performing TAB shall have a minimum of forty hours of specialized training in TAB, a minimum of one year experience in performing TAB work, and completed at least three other TAB jobs similar in nature to this contract.

1.5 SUBMITTALS

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NOTE: Where a "G" in submittal tags follows a submittal item, it indicates Government approval for that item. Add "G" in submittal tags following any added or existing submittal items deemed sufficiently critical, complex, or aesthetically significant to merit approval by the Government. Submittal items not designated with a "G" will be approved by the QC organization.

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Submit the following in accordance with Section 01330, "Submittal Procedures."

SD-06 Test Reports

[Certified DALT report]

Certified TAB report

SD-07 Certificates

Qualifications and experience

Design review report

Pre-field DALT preliminary notification

Pre-field TAB engineering report

Instrument calibration

1.6 QUALITY ASSURANCE

1.6.1 Certificates

1.6.1.1 Qualifications and Experience

Within 60 calendar days after the date of contract award, submit the following as proof of qualifications and experience.

a. List, by person, all special training that the personnel who will perform the TAB work have received. Provide proof of training. Provide proof of AABC or NEBB certification, if applicable.

b. List, by person, the number of years experience that the personnel who will perform the TAB work have had in the field of TAB.

c. Provide completed final TAB reports for three similar TAB jobs performed by the personnel who will provide the TAB work under this contract. The names and signatures of the TAB personnel who performed the work and the date the work was performed shall be listed on each report. Include the name and telephone number of the current maintenance supervisor or other suitable contact for each of the three jobs.

1.6.1.2 Design Review Report

Submit typed report describing omissions and deficiencies in the HVAC system's design that would preclude the TAB team from accomplishing the duct leakage testing work and the TAB work requirements of this section. Provide a complete explanation including supporting documentation detailing the design deficiency. State that no deficiencies are evident if that is the case.

1.6.1.3 Pre-Field DALT Preliminary Notification

Verify that duct installation is complete and notify Contracting Officer in writing that HVAC system is ready for DALT. Testing shall be in accordance with SMACNA HVACADLTM.

1.6.2 Reports

1.6.2.1 Pre-Field TAB Engineering Report

Fifteen days prior to testing, submit a report containing step-by-step procedure which are in full compliance with NEBB TABES or AABC NSTSB and describing a complete methodology for accomplishing TAB field work from start to finish. Provide a listing of all instruments which will be used. Also provide a copy of their calibration certificate showing calibration date and calibration expiration date. Indicate the range of measurement for each instrument to be used.

[1.6.2.2 Certified DALT Report

a. Report format: Submit report data on Air Duct Leakage Test Summary Report Forms as shown on Page 6-2 of SMACNA HVACADLTM. In addition, submit in the report, a marked duct shop drawing which

identifies each section of duct tested with assigned node numbers for each section. Include node numbers in the completed report forms to identify each duct section. TAB supervisor shall review and certify the report.

]1.6.2.3 Certified TAB Report

Submit certified TAB report with a certification statement which attests that the procedures executed have been in full compliance with the requirements of NEBB TABES, AABC NSTSB, or SMACNA HVACTAB. Certification shall further attest that any/all known deficiencies in operation, performance, or water/air flows are clearly identified herein. Submit report in the specified format including the following data:

a. Report format: Submit completed report forms for each of the following; as a minimum, report all data as contained on standard NEBB TABES, AABC NSTSB, or SMACNA HVACTAB report forms as contained within the referenced standards:

(1) Air Systems

(a) Fan report for rooftop units, central air handlers, supply fans, exhaust fans, fan coil units, heat pumps, packaged terminal units. Include running amps on fan motors and compressor motors.

(b) Duct traverse supply/return/exhaust/outside/relief ducts.

(c) Terminal supply, return, and exhaust outlets. Include measured external pressure at duct terminal.

(d) Hot/chilled water coils--report entering/leaving, wet/dry bulb temperatures.

(e) DX cooling coils-reports entering/leaving, wet/dry bulb temperatures.

(f) Unit heaters.

(g) Condensing units/compressors/condensers--report rated/actual compressor amperages/voltages. Also, report condenser entering and leaving water and air temperatures, both design and actual.

(2) Water Systems

(a) All pumps. Include running amps on pump motors.

(b) All flow control balancing valves, circuit setters, flow orifices, venturis--report size, flow, measured pressure drop, setting, manufacturer, model.

(c) Hot water, chilled water coils.

(d) Hot water converters, heat exchangers. Include entering and leaving temperatures.

(e) Unit heaters, convectors, fan coil units, fin tube radiation.

Bind report neatly with a waterproof cover. It shall contain a table of contents, with each page numbered. Type report data. Handwritten data will not be accepted.

b. Temperatures: Indicate temperatures on each TAB report form for each HVAC thermal energy transfer equipment. Include the indoor and outdoor wet and dry bulb temperature range within the recorded TAB data.

c. Instruments: List the types of instruments actually used to measure the TAB data. Include in the listing each instrument's unique identification number, calibration date, and calibration expiration date.

1.6.3 Modifications of References

Accomplish work in accordance with referenced publications of AABC or NEBB except as modified by this section. In the references referred to herein, consider the advisory or recommended provisions to be mandatory, as though the word "shall" had been substituted for the words "should" or "could" or "may" wherever they appear. Interpret reference to the "authority having jurisdiction," the "Administrative Authority," the "Owner," or the "Design Engineer" to mean the "Contracting Officer."

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

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NOTE: The designer has the responsibility on whether, or not, to require leak testing in accordance with SMACNA HVACADLTM. Duct systems, operating at one kPa (gage) 4 in. w.g. and above, having long runs and/or significant duct surface area should be tested. Duct systems having short runs of ductwork, or that are contained within the space served do not warrant leak testing with SMACNA HVACADLTM. Also, low velocity round duct systems do not warrant testing. When SMACNA HVACADLTM testing method is used, the designer shall indicate on the drawings (in addition to the duct class, seal class, and leakage class) the leakage test pressure to be used to test all ductwork, or duct sections. Refer to SMACNA HVACADLTM, Appendix B, "Sample Leakage Analysis" for guidance in determining leakage test pressures.

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3.1 TAB PROCEDURES

3.1.1 TAB Field Work

Test, adjust, and balance the listed HVAC systems to the state of operation indicated on and specified in the contract documents. Proportionately balance and report air systems and water systems in certified TAB report.

Provide instruments, with instrument calibrationcertificate, and consumables required to accomplish the TAB work. Conduct TAB work, including sound measurement work, on the listed HVAC systems in conformance with the AABC NSTSB, or NEBB TABES, and NEBB MASV, except as modified by this section:

3.1.1.1 Workmanship

Conduct TAB work on specified HVAC systems until measured parameters are within plus or minus 10 percent of the design values, that is, the values specified or indicated on the contract documents.

3.1.1.2 Air Distribution Systems

Balance air flow rates at supply outlets, return inlets, exhaust outlets, relief outlets, an outside air intakes to plus ten percent or minus ten percent of the design values. Adjust dampers, fan pulleys, and other air distribution devices to balance the system. Thee work may include measuring air velocities, velocity and static pressures, air flow rates, temperatures, and rotational speeds. Provide, seal, and label test holes in HVAC ductwork as required to accomplish the TAB work. Where air balance work involves cooling coils, perform balancing when the coil is in a "wet coil" condition. This shall be accomplished by one of three ways, as follows:

a. Perform work when coil is operating in the cooling mode. This is the preferred method, however, it may require postponing the air balance work related to the cooling coils until the outdoor temperature permits operation of the cooling equipment.

b. Simulate a wet coil by spraying water on the coil. Note, this may not be feasible or practical in some cases.

c. Using the coil manufacturer's air friction data and fan capacity curve, estimate the wet coil air flow rate by plotting the measured dry coil air flow rate and measured fan static pressure on the fan curve, adding the additional pressure drop imposed by a wet coil, and determining the wet coil air flow rate. A ratio of dry coil to wet coil flow rate can then be obtained and the balance work can be performed by correcting all dry coil air flow ratio measurements by this ratio. When this method is employed, the manufacturer's data, fan curves, and related calculations shall be included in the TAB Report. Note, this method shall only be used when there is a reasonable amount of confidence in the accuracy of the calculations.

3.1.1.3 Water Distribution Systems

Balance water flow rates at terminal devices to plus or minus ten percent of the design values. The work shall include measuring and adjusting all flow control balancing valves, pump discharge balancing valves, and other manually adjustable balancing valves. The work may include measuring the differential pressure across flow control balancing valves, pumps, coils and other equipment.

3.1.1.4 HVAC Equipment

Obtain electrical data; measure pressures and temperatures; measure rotational speeds; record equipment nameplate data; record required part,

model, and serial numbers; make physical measurements; and obtain other data as required in order to submit acceptable Data Report Forms in the TAB Report.

3.1.2 Data From TAB Field Work

After all TAB work has been completed, prepare a handwritten certified, pre-final TAB report using all report forms complete as specified for the final certified TAB report. Except as approved otherwise by the Contracting Officer, in writing, the TAB work and the TAB report shall be considered incomplete until TAB work is accomplished to within the accuracy range specified in the paragraph entitled "Workmanship."

3.1.3 Quality Assurance For TAB Field Work

3.1.3.1 Field Check

Verbally notify the Contracting Officer that the field check of the pre-final, handwritten report can commence. Give this verbal notice 10 days in advance of when the field check of the pre-final report can commence. Do not schedule the field check of the pre-final report until the TAB work is accomplished to within the accuracy range specified in the paragraph entitled "Workmanship" or written approval of the deviations from the requirements has been received from the Contracting Officer.

a. Recheck: During field check, the Contractor shall recheck, in the presence of the Contracting Officer, random selections of all reported data recorded in the pre-final report.

b. Areas of recheck: Recheck points and areas selected by the Contracting Officer.

c. Procedures: Measurement and test procedures shall be the same as was used for forming basis of the pre-final report.

d. Recheck selections: Selections for recheck will not exceed 25 percent of the total number of reported data entries tabulated in the pre-final report.

3.1.3.2 Retests

If random tests reveal a measured value which is an out-of-tolerance quantity, the report is subject to disapproval at the Contracting Officer's discretion. In the event the report is disapproved, readjust and test all systems, record new data, submit new pre-final report, and conduct new field check at no additional cost to the Government.

3.1.3.3 Out-of-Tolerance Quantity

Out-of-tolerance quantity pertains to field checking of the pre-final report. The term is defined as measurement taken during field checking which does not fall within the range of plus 10 to minus 10 percent of the original measurement reported on the pre-final report for specific parameter.

3.1.3.4 Report Acceptance

On completion and approval of the pre-final report field check, prepare, assemble, and submit the final certified TAB report in the required format

for final review/approval.

3.2 MARKING OF SETTINGS

Permanently mark the settings of HVAC adjustment devices including valves, splitters, and dampers so that adjustment can be restored if disturbed at any time. The permanent markings shall indicate the settings on the adjustment devices which result in the data reported on the submitted certified TAB report.

3.3 MARKING OF TEST PORTS

The TAB team shall permanently and legibly mark the location points of the duct test ports and incorporated on the final drawings. If the ducts have exterior insulation, these markings shall be made on the exterior side of the duct insulation.

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NOTE: Suggestions for improvement of this specification will be welcomed using the Navy "Change Request Forms" subdirectory located in SPECSINTACT in Jobs or Masters under "Forms/Documents" directory or DD Form 1426. Suggestions should be forwarded to:

Officer In Charge
Seabee Logistics Center
NAVFAC 15G/SLC 46
4111 San Pedro Street
Port Hueneme, CA 93043-4410

FAX: (805) 985-6465/982-5196 or DSN 551-5196

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-- End of Section --